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Publications

Mohammed H.I. Dore and Rubén Guevara
(eds.), *Sustainable Forest Management and
Global Climate Change: Selected Case Studies
from The Americas*. Edward Elgar Publishing,
Cheltenham, 2000

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This book comprises a comprehensive selection of studies dealing with forest management in the Americas and its relationship with carbon storage. As a result it differs from other references on forestry that are more concerned with the driving forces behind deforestation and the policies that aim to control them. The book is an important contribution as it demonstrates the relevance of forests to climate change policies, an issue that is always avoided in official international reports on climate change that instead are very much oriented to energy aspects.

At the time it was written, the Kyoto Protocol—that sets emission rights and obligations over carbon release into the atmosphere under the UN Framework Convention for Climate Change (UN FCCC)—was struggling to be ratified by signatory countries. The Protocol, nevertheless, proposes flexible mechanisms on carbon savings trade between countries to achieve their emission caps, namely: the clean development mechanism (CDM), the international tradable quotas (ITQ), and the already known joint implementation (JI). While JI is a bilateral project-based agreement, CDM and ITQ allow for the creation of an international market for carbon. ITQ is a trade scheme for quotas among countries with emission caps and CDM is a mechanism that allows countries with no binding emissions to sell carbon savings to those with caps. In this new context of CDM, the amount of carbon captured by forests can form significant sources of carbon savings to be traded, thereby generating additional revenues for preservation practices that will counteract the driving forces of deforestation. This is the itinerary of this book.

Part I of the book deals with the biophysical aspects of forestry and carbon-related management. It reveals in great detail ways of implementing forest management plans with an emphasis on economic and social aspects. Chapter 1 (Saénz and der Beek) offers guidelines for forest planning. A case study in the highland oak forests of Costa Rica shows how management, although diverse and specific for each forest, can be conciliated with sustainable practices, resulting in social and economic benefits. Also in Costa Rica, Chapter 2 (Schultz) presents a case study of forest management in which GIS are applied to demonstrate the possibilities for integration of socioeconomic and biophysical data.

Carbon counting in soil and vegetation is not a trivial task, as demonstrated in Chapter 3 (Johnston and Uhlig) in the case of forests in Northern Ontario, Canada. Different forms of measurement produce different results, demonstrating the importance of sampling in the estimation process.

Part II is devoted to economic valuation of boreal and tropical forests. The chapters in this section use a diversity of methodologies to determine values for forest services that are not captured in markets. Although lack of data constrains analysis, all chapters aim to demonstrate how sustainable activities can succeed if proper pricing is in place to capture them. Carbon sequestration payment is a potential candidate that may play a decisive role in allowing sustainable forest services to compete with activities that convert forestland. Chapter 4 (Dore and Johnston) is an interesting study that estimates the shadow price of one hectare of forest based on carbon captured in Canadian boreal forests in terms of the value of carbon released under forest exploitation. Based on an econometric study applying a model of dynamic maximization, the value of these forests carries a premium of the order of 20 per cent to reflect carbon release costs.

Following a distinct approach, Chapter 5 (Ramirez) is an attempt to estimate carbon values in the tropical forests in Costa Rica. Based on carbon content measures of these forests, the author estimates, under different forest management options, how much carbon could be secured and consequently exchanged in an international market. Although data constraints are dominant in the estimation procedures, the author concludes that current payments to land owners for sustainable practices already existing in Costa Rica are half of the carbon values they stock when a carbon price of US\$ 10t/C is assumed. The author also points out that if those carbon prices were paid to forest owners, sustainable forest management could compete with the land conversion activities that cause deforestation.

Accounting for forest carbon can also be valuable in developed countries for promoting a switch in land use from agriculture to forestry. Chapter 6 (Dore, Kulshreshtha, and Johnston) addresses this approach applied to marginal lands used for agriculture in northern Saskatchewan, Canada. The methodology applied is based on ranking alternatives, using stochastic dominance in comparisons between net social benefits of agriculture and forestry activities in the region, simulated over the last three decades. Data on the estimation of net benefits were not complete enough to reflect social value added and its possible variation through time, but the stochastic modeling allows for control of the discounting factor effects on the valu-

ation. Since marginal lands are currently presenting declining yields, the authors were thus able to show that forestry activities may not only maximize economic gains, but also create CO₂ savings that could attract investments from fossil fuel burning industries in Canada. It is possible, therefore, that the heavy subsidies currently in place to sustain the region's agriculture could be reformed towards forestry.

Chapter 7 (Ammour, Windevoxhel, and Sención) is a heroic attempt to undertake an economic valuation of mangroves in the Pacific coast of Nicaragua. The methodology is the usual partial and static model of estimating foregone use and non-use values of a natural resource. In this case, values arise from the depletion of mangroves in the region, such as: wood, fishing, recreation, carbon sequestration, and biodiversity. As is normal in the case of environmental valuation, biophysical aspects and measures are the main obstacles to the application of a monetary value. The authors attempt to estimate the ecological relationships between deforestation and the losses of goods and services, as well as soil erosion and biodiversity. In doing so, they either resort to dose-response functions estimated elsewhere, or make educated guesses. Conservative values are used, for example the price of carbon price was valued at US\$ 5.5/t, although sensitive analyses were not taken in all cases. The authors also undertook contingent and travel cost methods for recreation, but relied on international funding expectations to value biodiversity losses. The results are both sound and useful in demonstrating how the sustainable management of mangroves will depend on finding payments for non-commercial forest services.

The closing section of the book, Part III, addresses forestry policy initiatives in Canada, Costa Rica, and Brazil. Chapter 8 (Kulshreshtha) presents the experiment of the Canadian Model Forest Program that intends to offer a participatory approach in dealing with forest issues. Analysis is carried out on Prince Albert Forest where significant research has produced an inventory of resources, and an understanding of ecosystems and socioeconomic information. The design and implementation of the forest management plan has been produced in partnership with stakeholders. Although still in progress the authors offer several indicators from the experiment that demonstrate that participatory procedures associated with scientific knowledge can lead to sustainable forest management. However, it is not clear how this approach can be replicated elsewhere in other distinct socioeconomic and ecological contexts.

Chapter 9 (Segura-Bonilla) offers us a comprehensive and detailed review of forestry policy in Costa Rica that is a typical example of an attempt to use fiscal incentives and financial compensation schemes to deter deforestation by stimulating sustainable forestry practices. Instruments applied vary from payment to land owners to deep forest standing as carbon sinks, to incentives for the modernization of the timber industry. The author concludes that, despite all efforts, policy has failed to achieve the desirable results due to the lack of integration among policy initiatives, capacity to incorporate the claims of social actors, and rules to solve institutional conflicts. The chapter ends with a broad agenda for future research to address these issues.

Chapter 10 (Kegen, Pareyn, Barcellos, and Campello) describes the semi-arid region of the northeast of Brazil (Caatinga) where a type of thornbush vegetation is dominant. Although it is one of the poorest regions of Brazil and carries a high degree of biodiversity, the Caatinga does not attract as much attention as the tropical forests, such as the Amazon. The region has been under great pressure. Forest depletion is associated with the basic needs of the poor population, mainly related to the need for wood for fuel and small constructions. The chapter discusses in detail how forest management may, therefore, play an important role in providing these goods on a sustainable basis, and in securing social benefits for the region. The authors emphasize the relevance and need for further regional forestry research, as well as for adjustments in the existing credit schemes towards sustainable practices.

This book therefore directly addresses the relationship between ecological and economic sustainability aspects of forestry management. It draws from a diversity of methodological approaches and covers tropical as well as boreal forests. The literature may offer more sophisticated valuation exercises, but this book is a unique collection in which studies are confronted with real policy questions that are affecting the protection of important world ecosystems. Beyond simple monetary estimations, the contributing authors have succeeded in shedding light on ways to account for the still unpaid services of forests that on a global scale benefit the planet, and on a regional scale are essential to local communities. As a result, the authors have also attempted to take into account the expected potential market in carbon savings that the Kyoto Protocol may offer in order to create additional revenues for forest protection based on carbon processes. These processes, in which forests are viewed as sinks or stores for existing carbon which is sequestered in them, may decrease deforestation, or encourage reforestation and sustainable logging. Unfortunately, the full value of flexible mechanisms (CDM and ITQ) is not accounted for by the Protocol. Several countries, notably from the EEC, as well as several of the major international NGOs, do not support the inclusion of forests as carbon sinks and are reluctant to place a value on carbon sequestration processes within native forests, because of the difficulties associated with carbon counting. The fear of high leakage in forest options, often neglected in energy options, is consistently put forward to block these opportunities. Crediting forests as carbon sinks may ultimately undermine the Protocol if all Annex 1 countries choose to credit them against their own emission caps. Nonetheless, all agree that deforestation is one of the major sources of carbon release, as this book brilliantly describes. Without economic sustainability there will be no ecological sustainability from forestry management, particularly in developing countries. If the Protocol survives the recent American decision and becomes the first step towards combating climate change, lessons from this book should be considered in the plea for a fair recognition of sustainable forestry management as a vital source of carbon savings.

**Brian O'Neill, F. Landis MacKellar and
Wolfgang Lutz, *Population and Climate Change*.
Cambridge University Press, Cambridge, 2001.
ISBN 0 521 66242 7**

**Michael A. Toman (ed.), *Climate Change
Economics and Policy: An RFF Anthology*.
Resources for the Future, Washington DC, 2001.
ISBN 1 891853 04**

**William D. Nordhaus and Joseph Boyer,
*Warming the World: Economic Models of Global
Warming*. MIT Press, Cambridge Mass., 2000.
ISBN 0 262 14071 3.**

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The point of departure for *Population and Climate Change* is the observation that while 'Demographic trends and climate change will be two important themes of the 21st century', the relationship between them has been paid 'relatively little attention'. It is the aim of this book to examine that relationship. In Part 1 there are three chapters. The first summarizes the 1996 IPCC assessments in regard to climate change projections and impacts. Chapter 2 looks at recent demographic history, and reports global projections from IIASA for the next century. Chapter 3 reviews the literature on 'population–development–environment interactions'. From this background, Part 2 focuses on population–climate change links. Chapter 4 looks at the relationship between demographic trends and greenhouse gas emissions, and concludes that emissions growth is sensitive to population growth in the long run. Chapter 5 considers the question of whether reduced population growth would increase the ability of less-developed countries to adapt to climate change impacts. The answer given is 'yes'.

The final chapter, 6, asks whether the prospect of climate change strengthens the case for population policies that operate on the desired

number of children and the ability to realize the desired number. Given the findings in chapters 4 and 5 for developing countries, it is clear that the answer is going to be a fairly straightforward 'yes'. The situation in regard to some countries in the developed world is slightly less straightforward, as they already have very low fertility rates and, hence, concerns regarding future ability to provide adequate health care and pensions for an ageing population. In such countries, greenhouse gas emissions considerations work against policies to raise fertility, rather than providing additional arguments for reducing it. In so far as developing countries adopt policies that slow population growth, they confer a benefit on future generations in the developed world. This, it is argued, strengthens the case for the developed world to provide the developing countries with financial assistance for population policies.

As the authors of *Population and Climate Change* note, population policy is a sensitive area, especially in international relations, and it is perhaps for that reason that it rarely gets much attention in discussions about climate change policy. It does not feature in the other two books reviewed here, which take population as an exogenous variable.

Climate Change Economics and Policy: An RFF Anthology is exactly what its title says it is—a collection of papers, many previously published (though here updated) by Resources for the Future, dealing with climate change policy from an economic perspective. The papers are intended to be non-technical and accessible to a wide readership. There are 27 papers (three of which, for reasons which are unclear, get classified as Appendices), plus an introductory overview and a conclusion written by the editor. The papers are organized into four sections. Part 1 provides some background in terms of the development of the Kyoto Protocol and a brief survey of the costs that it implies, the link between CO₂ emissions and energy use, and a review of the economic approach to policy analysis. Part 2 looks at climate change impacts—on agriculture, water resources, forests, and health—and at the 'ancillary benefits' of policies to reduce greenhouse gas emissions. The papers in part 3 deal with a range of issues in the design and implementation of policy instruments, and part 4 looks at international considerations.

The book is well written and presented, and largely succeeds in the objective of being accessible to a wide readership. Each paper concludes with a list of 'Suggested Reading'. Some of the papers, especially from parts 3 and 4, could be useful as supplementary teaching materials in environmental economics courses. The coverage of the economic approach to policy analysis, based on efficiency criteria developed in terms of monetized costs and benefits, is reasonably comprehensive.

In *Warming the World: Economic Models of Global Warming*, Nordhaus and Boyer report results from two economic 'Integrated Assessment' models that they have developed. Each model comprises linked economic and climate sectors—GDP production in the former causes CO₂ emissions, which drive atmospheric concentrations of CO₂, which affect climate, which affects production. In the DICE model the world economy is a single sector. In the RICE model, with which what follows here is concerned, the world economy comprises eight regional economies, which do not trade

with one another. In the 'Base Case' each region maximizes a discounted sum of future utilities, ignoring any climate change externalities—in effect a global carbon tax is set at zero. In the 'Optimal Policy' case, a global carbon tax is set at a rate equal to world marginal willingness to pay for carbon abatement, where world willingness to pay is the sum of damages across the eight regions. This is equivalent to a regime of tradable emissions permits operating worldwide, with the permit price equal to the tax rate.

Other policy cases are considered, notably for versions in which global emissions are capped as required in the Kyoto Protocol. The versions differ as to the 'flexibility' involved. At one extreme, no permit trading is allowed, at the other permit trading is worldwide: the two intermediate cases restrict it to OECD countries and Annex 1 countries.

This is an impressive piece of work. The modelling is ingeniously parsimonious, and a lot of effort has gone into its calibration. The reporting of the work in the book is comprehensive, and the models are stated algebraically and in GAMS code. There is a chapter on 'Computational Procedures'—the models have been solved using EXCEL as well as GAMS, and the EXCEL spreadsheet, as well as the GAMS programmes, are available on the internet. It is possible for those interested to test the sensitivity of the results reported to alternative parameter values, to look at different policy regimes, or to experiment with alterations to the basic model structure. The results reported, in chapters 7, 8, and 9 are from the EXCEL version of the model, to which the description given above here relates.

Some of the major results highlighted in the book (chapter 9) are as follows:

1. An 'efficient' (that is, emerging from the 'Optimal Policy' run) climate change policy 'would be relatively inexpensive and would slow climate change surprisingly little'. From table 7.3 for 1995 implementation, global abatement costs would be \$98 billion (1990 US\$) and the benefit would be \$296 billion, in present value terms. A short delay in implementing such a policy has 'little cost'. For 2005 implementation, cost is \$92 billion and benefit is \$283 billion.
2. In regard to the Kyoto Protocol, its cost-effectiveness depends crucially on the permit trading arrangements allowed. Full global trading would be 'reasonably efficient' costing \$59 billion for benefits of £108 billion. With no trading, costs would be 15 times those in the full trade case, for benefits of \$161 billion, and a benefit cost ratio of 0.18 (table 8.8).
3. The Kyoto Protocol has 'significant distributional consequences' with the United States bearing most of the costs, either through abatement activities or permit purchase, and being a net loser. Table 8.6 shows the US bearing abatement costs varying from \$91 billion with global permit trading to \$852 billion with no permit trading.

There are now a number of economic models of this, and other kinds, that produce numbers for the costs of climate change and of policies to reduce it (see Appendix A in the RFF anthology for a brief survey of results regarding the costs of the Kyoto Protocol). The numbers vary across the models, and tracing the sources of the differences is difficult. In qualitative terms, most

economic analyses agree that the Kyoto Protocol is inefficient and would impose higher costs on the US than on most other Annex 1 nations, especially in the event that limited 'flexibility' were permitted. The US has, in fact, recently (and after this book was written) abandoned the Kyoto Protocol, on the basis of arguments very similar to the points made above, given the refusal of other nations to allow what it regards as sufficient flexibility.

In evaluating these sorts of arguments against the Kyoto Protocol, it is necessary to keep in mind that the numbers used are mainly driven by efficiency considerations, and to strive for some sense of perspective. Taking the worst case in regard to global costs and costs borne by the US, according to table 8.6 the global abatement costs for Kyoto with no trade would be \$884 billions of 1990 US dollars, in present value terms, and the costs to the US would be \$852 billions. For a population of 260 million the US cost is a present value of \$3,277 per capita. Turning that present value into a constant annual cost at 3 per cent gives approximately \$100 per annum. In 1995 US national income per capita was, according to table 3.7, \$22,862 in 1990 dollars. Loading virtually the entire cost of Kyoto, implemented in the worst possible way, on to the average US citizen, would, annually, cost them approximately one half of 1 per cent of their 1995 income. From table 3.7, in the Base Case, RICE projects that in 2100 US per capita income will have increased to \$53,480, to be about ten times that in China and 15 times that in the Low Income region.

Given all of the uncertainties involved, the RICE numbers do not persuade me that the Kyoto Protocol is a really bad thing, even with limited flexibility. Not ideal certainly, but not that bad, even from the point of view of the average citizen of the US.

Robert Mendelsohn and James E. Neumann
(eds.), *The Impact of Climate Change on the
United States Economy*. Cambridge University
Press, 1999.

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Climate change is often recognized as one of the most serious environmental problems of our days. There are plenty of studies about how to reduce greenhouse gas emissions, and what that would cost. Much less is

known about why we want to reduce emissions. There are many studies of the impact of climate change on particular systems in particular places, but overall assessments are scarce. The recent book edited by Mendelsohn and Neumann provides an overall assessment, and puts it in a welfare-theoretic framework at that. It should be noted that the assessment is confined to market sectors, including recreation, in the USA. The volume gathers ten chapters plus an introductory and a concluding chapter. The individual chapters, most of them written by leading authorities on the respective subjects, provide innovative methods and new insights.

For those reasons alone, this is a commendable book. But, there are other reasons to praise this book as well. It makes two long-awaited innovations in the climate change impact literature. Firstly, the ten studies in the book are all grounded in observations. Process-driven models—indirectly informed by the data—dominate the literature, but this book uses statistical models—directly looking at data. Admittedly, one has to make some jumps of faith: first that the past is representative for the future and, second, that space and time are substitutable. These assumptions are obviously wrong. It is no worse, however, than applying a complex, process-driven model well outside its domain of calibration and validation, which is what most other studies in the literature do.

A second major innovation, this book takes adaptation seriously. Previous studies wrongly assumed that climate would change and that people would behave in the exact same way as they do now. This book places human ingenuity to cope with a wide diversity of ever-changing circumstances at the heart of its analysis. That ingenuity may be overestimated a bit by the authors. Overregulation, misincentives, and divergence of individual and social welfare may stifle adaptation, but have little place in the smooth economic world of this book. For that reason, perhaps, the authors are a bit optimistic about the prospects of climate change. According to the analysis, the US economy would be stimulated by some warming and the US people would be better off. This is in sharp contrast to the majority of the climate change impact literature. This is a welcome contrast, as it acutely shows how little we know about why we would want to reduce greenhouse gas emissions.